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Confirmation No. 4893

PATENT



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Michael J. Collins et al.
Serial No.: 10/065,173
Filed: September 24, 2002
For: METHOD AND APPARATUS FOR
RAPID FAT CONTENT DETERMINATION

Group Art Unit: 1743
Examiner: Y. Gakh

January 4, 2005

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Commissioner for Patents
Alexandria, VA 22313-1450

APPEAL BRIEF UNDER 37 CFR § 1.192

This Appeal Brief is filed pursuant to the "Notice of Appeal to the Board of Patent Appeals and Interferences" mailed September 30, 2003, and received by the U.S. Patent and Trademark Office October 4, 2004.

1. ***Real Party in Interest.***

The real party in interest in this appeal is CEM Corporation, the assignee of the above-referenced patent application.

2. ***Related Appeals and Interferences.***

There are no related appeals and/or interferences involving this application or its subject matter.

3. ***Status of Claims.***

The present appeal involves Claims 1 and 2, which are currently under final rejection as set forth in the final Office Action mailed July 13, 2004. Claims 3 and 4 have been cancelled. The claims at issue, namely, Claims 1 and 2, are set forth in the attached appendix.

4. ***Status of Amendments.***

A final Office Action was mailed July 13, 2004, finally rejecting pending Claims 1 and 2 under 35 USC § 103(a). Applicants did not submit any claim amendments after this final Office Action.

5. ***Summary of the Invention.***

The present invention relates generally to a method and apparatus for rapid fat content determination of an organic sample, such as a food product. The presently claimed invention is a sample for nuclear magnetic resonance (NMR) measurement that includes an organic portion containing at least some fats and oils on a pad. The sample further includes a sheet material wrapped around the organic portion and the pad. Both the pad and the sheet material have certain recited properties that facilitate the use of microwave and NMR technology to evaluate the fat and oil content of the organic portion, as discussed below.

The ability to easily and efficiently evaluate the fat and oil content of organic substances can be of commercial importance. As a non-limiting example, commercial production of processed foods, such as hot dogs and cheese, requires close control of fat and oil content. Variations in fat and oil content can be detrimental to product quality and can adversely affect production economics. In addition, information regarding the fat content of a sample can provide useful information on texture, heat resistance, mouth feel, and flavor release. Further, many foods are subject to various statutory and regulatory labeling and content requirements with respect to the fats and oils they contain. Information about fat and oil content is often valuable or necessary in controlling various food processing techniques.

Traditional methods for determining the moisture and fat content of foodstuffs include extensive drying and solvent based chemical extractions. As discussed in more detail below, the Examiner relies in part on documents that exemplify solvent extraction techniques. Such methods, however, can be time consuming, and the time lag inherent in

widely used testing methods prevents production processes from operating at optimal efficiency. Furthermore, many methods require solvents that are expensive, often hazardous, and pose disposal problems.

As discussed in the Background section of the present application, scientists have long researched the use of NMR as a possible mechanism for determining fat and moisture content of foodstuffs. As understood in the art, NMR analysis is essentially a spectroscopic method that measures a phenomenon that occurs when the nuclei of certain atoms are placed in a static magnetic field and then exposed to a second oscillating electromagnetic field. Efficiently utilizing NMR as an alternative to solvent extraction for quantitatively determining the components of a sample, however, has proven difficult. This difficulty is especially prevalent in determining the fat and oil content of foodstuff samples.

For example, NMR resonance occurs over a narrow band for liquids, and this narrow window of NMR resonance is used to distinguish liquids from solids. Traditional fat and oil analysis takes advantage of this by melting all the fat and oil in a sample prior to NMR analysis. Because many foods have a relatively high moisture content, and because high moisture content usually makes NMR analysis unfeasible, food samples typically must be thoroughly dried prior to NMR analysis.

After the sample is dried, the sample is usually heated until all the fat and oil present in the sample is assumed to have melted, with the further assumption that the only liquid remaining in the sample is fat. Melting the fat and oil also means that a portion of the fat and oil may drain from the sample. As a result, when the sample is removed from the oven and prepared for NMR analysis, the sample no longer contains the same amount of fat and oil as did the original sample. As a further disadvantage, if aggressive heating techniques, such as very hot convection ovens or conventional microwave ovens, are used to speed drying of the sample, the chemical structure of the sample may be altered (e.g., meat is cooked) which may alter the NMR results and provide a less accurate -- or even highly inaccurate -- analysis.

In the present invention, a sample pad receives a sample to be analyzed, and the sample is dried by subjecting the sample to electromagnetic radiation in the microwave frequencies. After the sample is dried, the entire sample, along with the pad supporting the sample, is transferred to an NMR analyzer. The NMR analyzer identifies the response of protons in the sample that are associated with fats and oils. The NMR response of the sample is then compared to the NMR response of similar samples having a known fat and oil content. By making this comparison in conjunction with analysis of weight data collected before, during and after the drying step, a quantitative determination of the fat and oil content in the sample may be achieved.

The present application claims a sample for NMR measurement, suitable for use in the method described above. The sample includes an organic portion containing at least some fats and oils. In addition, the claimed sample includes a sample pad that is specifically designed for use in the NMR analysis method described above. As mentioned previously, current methods for fat and oil determination using NMR analysis tend to be less reliable measurements because a percentage of fat and oil are lost due to run off during melting. The claimed invention eliminates or reduces this uncertainty by providing a sample pad that may be directly transferred from the microwave drying device to the NMR analyzer and that conserves the entire sample for NMR analysis.

The sample pad is substantially transparent to microwave radiation and is free of atoms that would interfere with or mask the NMR response of the protons in the fats and oils in the sample. The claimed pad is also hydrophilic and lipophilic. During the drying step noted above, the sample and sample pad are preferably heated until at least a portion, preferably a large portion, and most preferably all, of the fat and oil in the sample are completely melted. Melting the fat and oil necessarily means that some of the fat and oil will drain from the sample. Because of its lipophilic nature, the sample pad collects or absorbs any fat and oil that drains from the sample, thereby preserving the fat and oil content in the sample for later NMR analysis, and thus enhancing the accuracy of the results. Stated

differently, the lipophilic nature of the pad ensures that any fat or oil melted during the drying of the sample is retained in the sample pad to enable an accurate weight measurement after the drying of the sample. In addition, the hydrophilic nature of the pad allows the pad to retain any liquid present in the original sample that may drain off prior to drying the sample thus enabling accurate weight measurement of the original sample.

The claimed invention further includes a sheet material that is also free of atoms that would interfere with or mask the NMR response of the protons in the fats and oils in the sample. This sheet material is wrapped around the sample and sample pad during the NMR analysis and aids in maintaining the integrity of the sample during NMR analysis.

Thus, the present invention allows the determination of the fat and oil content of organic samples without the inherent inaccuracy of known methods, which can possess a high degree of statistical uncertainty or are unsuitable for continuous production processes. The invention can facilitate rapid and accurate determinations of the fat and oil content of an organic sample that also contains moisture (i.e., hydrogen protons in water) in amounts that would otherwise preclude NMR determination of the fat and oil content. This, in turn, can improve the overall efficiencies of a production process.

6. ***Issues.***

The issues in the present appeal are as follows:

Whether Claims 1 and 2 are properly rejected under 35 USC § 103(a) as being unpatentable over Thompson (AOSTRA J. Res.) in view of Collins (U.S. Patent No. 4,554,132) or Bostian et al. (J. Assoc. Off. Anal. Chem.) and further in view of Jerosch-Herold et al. (U.S. Patent No. 5,289,124), and specifically:

Whether it is proper to combine the teachings of the cited references when there is no basis or motivation to make the proposed combination; and

Whether it is proper to combine the teachings of the cited references when the combination as applied by the Examiner is meaningless or inoperable.

7. ***Grouping of Claims.***

Claims 1 and 2 may be analyzed together.

8. ***Argument.***

The Examiner has taken the position that Claims 1 and 2 are obvious under 35 USC § 103(a) based on a combination of Thompson in view of Collins or Bostian et al. and further in view of Jerosch-Herold et al. Applicant respectfully submits, however, that there is no basis or motivation to combine the references as suggested by the Examiner. Indeed, Applicants submit that the combination as applied by the Examiner is meaningless or inoperable and cannot be properly applied as against the pending claims.

Thompson is directed to the analysis of an inorganic sample that is placed in a porous clay ("Alundum") thimble. In particular, Thompson discusses the analysis of "oil sand." Oil sand can be generally described as sand covered with a film of water and surrounded by a slick of bitumen. Sand is recognized in the art as an inorganic material, and to characterize it otherwise is simply incorrect.

The Examiner incorrectly characterizes the Thompson sample as an organic sample. To support this position, in the final Office Action mailed July 13, 2004, the Examiner argues that the "oil" in the oil sand makes the sample an organic sample. See page 4 of the final Office Action. Yet, based on this argument, the Examiner is in effect stating that Thompson analyzes the oil content of oil. This simply does not make sense and further contradicts one of the stated purposes of Thompson, namely, analyzing the oil content of sand. Page 135 of Thompson, the first paragraph under the heading "Introduction."

As discussed above, finding effective alternatives to solvent extraction to evaluate the fat and oil content of organic substances, such as foodstuffs, has proved especially difficult. Many foods have a relatively high moisture content, and because high moisture content usually makes NMR analysis unfeasible, food samples typically must be thoroughly dried prior to NMR analysis. Yet, if aggressive heating techniques are used to speed drying of the

sample, the chemical structure of the sample may be altered (e.g., meat is cooked) which may alter the NMR results and provide a less accurate -- or even highly inaccurate -- analysis.

Inorganic substances, such as the sand sample of Thompson, clearly differ in nature from the claimed organic sample. As such, different problems are associated with the analysis of the oil content of each. Accordingly, one of ordinary skill in the art would not look to Thompson, directed to the analysis of an inorganic sample, when developing a process for analyzing fat and oil content of a different type of substrate, such as the claimed organic sample.

Thompson differs in other respects from the claimed invention, as acknowledged by the Examiner. In Thompson, the inorganic sample is placed in a porous clay ("Alundum") thimble. The Examiner acknowledges that Thompson does not disclose placing a sample on a sample pad which is hydrophilic and lipophilic as claimed. See page 3 of the final Office Action. The Examiner also does not argue that the Thompson thimble is free of atoms that would interfere with or mask the NMR response of the protons in fats and oils as claimed, and Thompson is unclear on this point.

Thompson does not indicate any problems associated with the use of the clay thimble disclosed therein. Thompson further does not suggest specific properties for the thimble to be effective in the disclosed process. Indeed, the Examiner acknowledges that Thompson does not disclose placing a sample on a sample pad which is hydrophilic and lipophilic, and the Examiner is silent with respect to the NMR transparency of the Thompson clay thimble. Accordingly, there is no motivation to substitute the clay thimble of Thompson with any other sample container. The only motivation to seek any substitute for the clay thimble is an improper hindsight analysis based on the Applicants' own disclosure.

Collins or Bostian et al. cannot overcome the deficiencies of Thompson. Collins and Bostian et al. both disclose the analysis of food or similar organic samples on either filter paper (Collins) or a glass fiber pad (Bostian et al.). Neither, however, carries out any steps

with the paper or pad that would require -- and thus neither suggests -- that the sample pad is NMR transparent.

In addition, both Collins and Bostian et al. are directed to analytical methods that differ significantly from the Thompson method. Collins and Bostian et al. use solvent extraction to quantify oil content of the organic sample. Yet, as discussed herein, solvent extraction is undesirable for various reasons, and one advantage of the claimed invention is the elimination of solvents and the problems attendant with the use of the same. One skilled in the art, seeking to avoid the use of solvents and the problems associated with the use of the same, would not look to either Collins or Bostian et al., both of which specifically require solvent extraction.

Further, Thompson measures oil content present in the sample and requires that oil remain in the sample to quantify the same. In contrast, Collins and Bostian et al. take an opposite approach by actually removing oil from the sample (via solvent extraction) and thereafter determining oil content based on the weight loss of the sample. Accordingly, any sample treated using the Collins or Bostian et al. method will no longer contain any fat or oil. Thus, one skilled in the art would not combine the teachings of Thompson with either Collins or Bostian et al. for this reason as well.

The Examiner refers to Column 5, line 5 of Collins. Yet, this cited portion of the Collins patent actually emphasizes the differences in the Thompson and Collins methods and the equipment required to conduct the same. Column 5 of Collins discloses completely removing a sample from the filter paper and placing the sample in a solvent bath to leach and extract the soluble substrates. Column 5, lines 9-10. Alternatively, Collins extracts the oil *in situ* using filter paper that allows the solvent to pass through the paper to extract solubles in the sample. Column 4, lines 63-64. Both examples require filter paper that differs in structure and function from the clay thimble of Thompson. This further emphasizes the absence of any basis or motivation to substitute the thimble of Thompson with the filter paper of Collins.

The Examiner further acknowledges that Thompson, Collins and Bostian et al. do not disclose a sheet material free of protons which wraps the sample on the pad. See page 3 of the final Office Action. Yet, not only do Thompson, Collins and Bostian et al. fail to teach such a sheet material; neither Collins nor Bostian et al. carries out any steps with the filter paper or pad that would require -- much less suggest -- a further wrap in an NMR-transparent material.

The Examiner relies upon Jerosch-Herold et al. as disclosing samples for NMR relaxation measurements sealed with Teflon tape. Yet, Jerosch-Herold et al. add nothing to the combination that provides any relief from the failures of the Thompson and Collins or Bostian et al. combination. Further, the combination proposed by the Examiner is meaningless or inoperable and cannot be properly applied as against the pending claims.

Jerosch-Herold et al. is from a non-analogous art: the determination of the fluid-flow permeability of porous of porous media (e.g., "loose sediments and sedimentary rocks," column 1 line 36). To carry out its analysis, Jerosch-Herold et al. require that the porous media be "saturated with a liquid" during the analysis. This requirement is found in claim 1, in the Summary of the Invention (column 3 beginning at line 45), and in the "Experimental Procedure" (column 8 beginning at line 37). In particular, the "Experimental Procedure" describes placing the samples in sealed containers and "imbibing" them with water for "several hours." Other than the use of NMR spectroscopy and mentioning applying Teflon tape to a sample, no reason exists for a person of skill in the art of determining fat and oil content, or a person of skill in the art of microwave extraction, or a person of skill in the art of porous underground rock formations, to combine the techniques found in these references.

Accordingly, when presented with these four references -- two of which are unrelated to fat and oil analysis of organic samples -- the skilled person is given the choice of an inorganic sample in a clay sample holder (Thompson), an organic sample in a filter paper or

glass fiber pad (Collins or Bostian et al.), or an inorganic sample soaked with liquid and wrapped in Teflon tape (Jerosch-Herold et al.). There is no motivation or suggestion to combine the references in the manner presented by the Examiner.

In addition, the combination proposed by the Examiner produces inoperative results. The sample described in Jerosch-Herold et al. must be saturated with liquid to obtain the desired NMR measurement. Yet, maintaining Jerosch-Herold's saturated sample would be impossible in the presence of the Collins or Bostian et al. filter paper or glass fiber pad. The use of the Collins or Bostian et al. filter paper or glass fiber pads, or indeed the lipophilic and hydrophilic pad of the claimed invention, would remove liquid from Jerosch-Herold's saturated sample, thus ruining Jerosch-Herold's resulting measurements. Accordingly, because the use of the Collins filter paper or the Bostian et al. glass fiber pad, or even the hydrophilic pads of the claimed invention, would render the Jerosch-Herold et al. method inoperable, the combination is likewise inoperable.

Contrary to the Examiner's arguments on page 4 of the final Office Action, the Applicants are not incorrectly interpreting the Examiner's rejection. The Applicants are simply reading Jerosch-Herold in its entirety for all that it fairly teaches, including portions that teach away from the claimed invention. Because the Examiner suggest a modification of a cited reference that would render it unsatisfactory for its intended purpose, there is accordingly no suggestion or motivation to make the proposed modification.

In the present application, to support the position that the claimed invention is obvious, the Examiner must pick and choose from disparate teachings of various references, two of which are unrelated to fat and oil analysis of organic samples. The law is clear that an Examiner must be able to point to something in the prior art that suggests in some way a modification of a particular reference or a combination with another reference to arrive at the claimed invention. *In re Fine*, 837 F.2d 1071, 5 USPQ 2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ 2d 1941 (Fed. Cir. 1992). Absent such a showing in the prior art, the Examiner has impermissibly used the Applicants' teaching to hunt through the prior art

for the claimed elements and combine them as claimed. *In re Laskowski*, 871 F.2d 115, 117, 19 USPQ 2d 1397, 1398 (Fed.Cir. 1989); *see also In re Fine*, 837 F.2d 1071, 5 USPQ 2d 1596 (Fed. Cir. 1988) (“One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.”). Such a showing is missing in the present application, thereby resulting in an improper hindsight analysis to support a conclusion of obviousness.

Further, the combination proposed by the Examiner is actually inoperable, and the skilled person would not use it. The law is also clear in this regard. If the proposed modification would render the prior art being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Such is the case with the Examiner’s proposed combination, which would remove liquid from Jerosch-Herold’s saturated sample, thus ruining Jerosch-Herold’s resulting measurements. Therefore, the Examiner’s combination directs the skilled person away from, rather than towards, the claimed invention.

Accordingly, the Applicants respectfully submit that the references have been applied in hindsight with the Examiner merely selecting the desired elements from each reference while ignoring the overall teaching of the references and similarly ignoring the overall frustration of purpose that the combination would bring. Therefore, the Applicants submit that the combination fails to render the pending claims obvious.

CONCLUSION

The cited documents fail to teach or suggest the claimed invention, and further the combination as applied by the Examiner is meaningless or inoperable and cannot be properly applied as against the pending claims. The Examiner has accordingly failed to make a prima

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facie case of obviousness, and the Applicants respectfully submit that the Board reverse the rejection of record and order immediate allowance of all pending claims in this case.

Respectfully submitted,



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Andie Crumpler

APPENDIX

1. A sample for NMR measurement comprising:

an organic portion containing at least some fats and oils on a pad that is hydrophilic and lipophilic and substantially transparent to microwave radiation and is free of atoms that would interfere with or mask the proton NMR response of the protons in the fats and oils in the sample; and

a sheet material that is free of atoms that would interfere with or mask the NMR response of the protons in the fats and oils in the sample, said sheet material being wrapped around said organic portion and said pad.

2. A sample according to Claim 1 at a temperature at which the fats and oils are partially melted.